ANESTHESIA IN DISEASES OF THE SPINAL CORD.

By PHILIP COOMBS KNAPP, A.M., M.D.,

Clinical Instructor in Diseases of the Nervous System, Harvard Medical School; Physician for Diseases of the Nervous System, Boston City Hospital.

The clinical studies of Ross,[2] Thorburn,[3] Starr,[4] Head,[5] Kocher,[6] and many others, supplemented by the anatomical and physiological researches of Herringham,[7] Paterson,[8] and Sherrington[9] have established the fact that the anesthesias or other sensory disturbances due to lesions of the spinal cord have a fairly definite distribution according to the particular segment of the cord involved. These areas follow the rule laid down by Herringham, that, of two spots on the skin, that which is nearer the preaxial border tends to be supplied by the higher nerve; and of two spots in the preaxial area, the lower tends to be supplied by the lower nerve; and of two spots in the postaxial area, the lower tends to be supplied by the higher nerve. That the exact boundaries of these areas are not yet established is apparent when we note the variations between the diagrams of Thorburn, Starr, Kocher, and Head; yet, in spite of minor differences, there is a general agreement between them. Sherrington, moreover, has shown that the areas supplied by the different spinal roots overlap; that if one root be cut, there is no resulting anesthesia, because its area is supplied by fibres from the next roots above and below; so that in order to obtain anesthesia in the area of the first root, these other two roots must also be cut.

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[2] Brain, X., p. 333. 1888.

[3] Brain, XVI., p. 355. 1893. "A Contribution to the Surgery of the Spinal Cord."

[4] American Journal of the Medical Sciences, July, 1892. Brain, XVII., p. 481. 1894.

[5] Brain, XVI., p. 1, 1893; XVII., p. 339, 1894; XIX., p. 153, 1896.

[6] Mittheilungen aus den Grenzgebieten der Medizin und Chirurgie, Bd. I., H. 4.

[7] Philosophical Transactions of the Royal Society, CLXXVII., 1887.

[8] Journal of Anatomy and Physiology, XXVIII., pp. 84, 169. 1894.

[9] Philosophical Transactions of the Royal Society, CLXXXIV., B., p. 641. 1893.

It is hardly necessary here to give a description of the different areas of anesthesia due to lesions of the different spinal segments, or to report more cases confirming the facts already established. It is sufficient to say that when we find anesthesia confined to these areas, we are warranted in diagnosticating a lesion in the corresponding segment of the spinal cord, and the knowledge of this relation between definite areas of anesthesia and lesions of definite segments of the cord is probably the most important aid in the diagnosis of spinal disease that we have acquired in the past fifteen years. Anesthesias which have such a distribution, rendered familiar by the diagrams already referred to, may be termed spinal anesthesias. The distribution of anesthesias due to lesions of the peripheral nerves, peripheral anesthesias, was recognized long before this, and the diagrams of such distribution are to be found in most of the text books. In other diseases, notably in hysteria, the boundary of the anesthesia, instead of following either of the above types, may pass directly around the limb at right angles to its axis, and the anesthesia may occupy the area ordinarily covered by a sleeve, a glove, a stocking, or a sock, or it may cover the complete half of the body. Such a distribution, occurring as it often does in cases of cerebral disease, may be spoken of as the cerebral type, although the term, used only for convenience, should not be taken as denoting definitely the nature of the anesthesia. (Fig. I.)

Although we may thus classify sensory disturbances according to their distribution as peripheral, spinal, and cerebral, and, although this classification is of distinct help in diagnosis, the distinction is by no means absolute. In one affection of the spinal cord, namely syringomyelia, it has been generally held that thermo-anesthesia and analgesia occupy "symmetrical segments on both the uper and lower limbs: on a diagram we might say that the patient has socks and gloves of thermic insensibility."[10] The accompanying diagram will show this clearly. The first case, M. C. (Figs. II. and III.), was reported by the late Dr. Jeffries,[11] and the first diagram is taken from his paper. The second observation was made several years later, and at that time there had developed a much greater degree of muscular atrophy in the arm. In

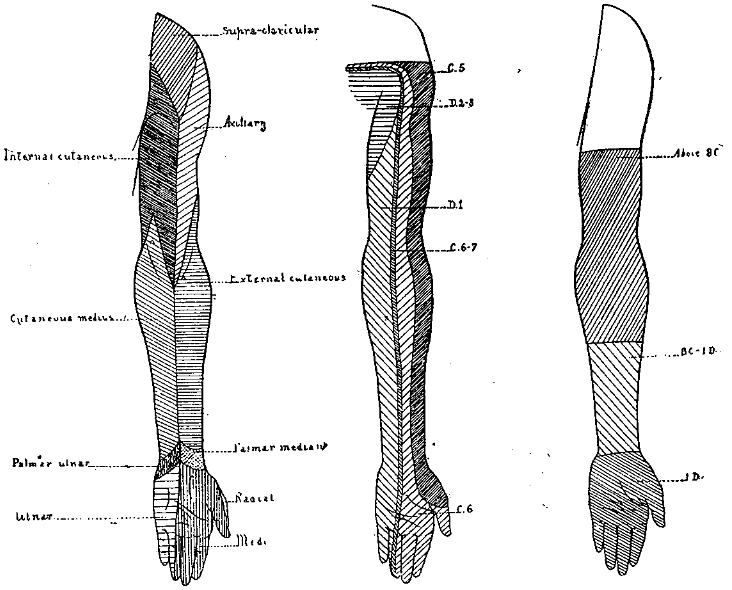

Fig. I.—Types of anesthesia: A, peripheral (from Hasse); B, spinal (root type of Chipault) (from Kocher); C, cerebral (medullary type of Chipault) (from Brissaud).

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[10] Bruhl: "Contribution à l'étude de la syringomyélie," p. 20. 1890.

[11] Journal of Nervous and Mental Disease, Sept., 1890.

consequence of a severe burn of the right arm, the elbow had been excised. The area of subjective numbness in the upper extremity, noted in 1889, had now become hypoesthetic, and there was an area which was hypoesthetic to pain, touch, and temperature on the anterior aspect of the lower abdomen and upper thigh, not coinciding with the area of subjective numbness of 1889. In 1889 the areas of sensory disturbance might have been regarded as of the spinal type, but in 1894 they seem more distinctly cerebral.

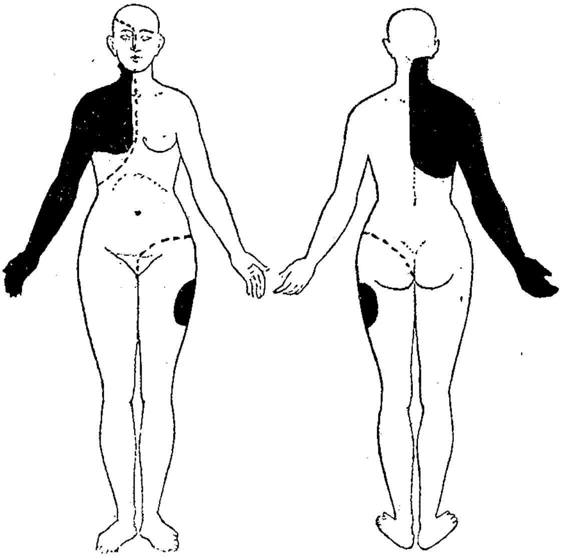

Fig. II.—M. C. Syringomyelia, 1889. Thermo-anesthesia and analgesia. Dotted line limits area of subjective numbness.

The second case, W. H. (Figs. IV.-VI.), was a man of thirty-seven, seen by me in 1892. He had a congenital spina bifida, operated on in 1891, and "spinal meningitis" in 1870. The trouble was of gradual onset. In 1883 he began to notice that the right leg dragged, and the weakness increased so that in 1884 he had to use a cane to walk with. The left leg also became affected, and in 1888 he had to use crutches. In 1884 he began to notice a loss of sensibility in the left leg and hand, and a year or so later the right hand grew clumsy; he could not direct his movements, especially with the eyes closed, and the hand gradually became weak. He began to have rigidity in the limbs and pain in the back and thighs. He had some loss of control of the sphincters. The movements of the right arm were considerably impaired, but there was no ataxia. The movements of both legs were much impaired, the right more than the left. He could not raise the toes or the heel from the ground on the right side. There was some extensor spasm in the legs, with a tendency to cross-legged rigidity. The knee jerks were not exaggerated. There was no noticeable atrophy and no change in the electrical reactions. The sense of position was impaired in the right forearm and right leg. The other sensory disturbances are shown in the diagrams. When first seen the anesthesia extended only to the level of the clavicle, but later it extended to the left side of the head.

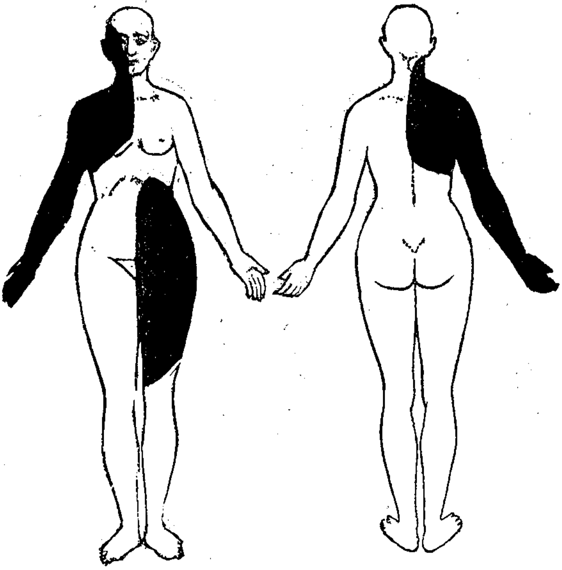

Fig. III.— M. C. Syringomyelia, 1894. Hypoesthesia to pain, touch and temperature.

From the earlier history and the first observation of the loss of tactile sensibility this case might fairly be regarded as one which presented the phenomena of a unilateral lesion of the cord; the anesthesia being probably of the spinal type. The later history shows that the left side of the cord was subsequently invaded, and the distribution of the analgesia and thermo-anasthesia is clearly of the cerebral type.

As I have already said, it has generally been admitted that the disturbances of sensation in syringomyelia followed the cerebral type, and many such cases might be collected, as, for example, to cite only a few of the reported cases where diagrams of these disturbances are given, the cases of Bruhl,[12] Roth,[13] Lloyd,[14] Souques,[15] Schles-

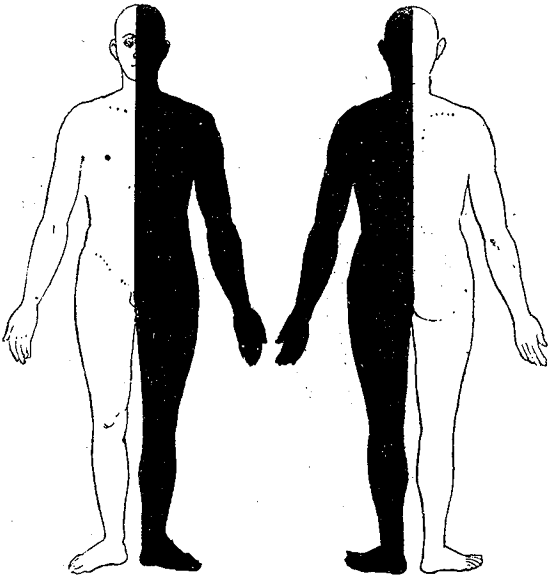

Fig. IV.—W. H. Syringomyelia. Anesthesia.

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[12] Bruhl: op. cit.

[13] Archives de Neurologie, Nov., 1887; March, July, Sept., Nov., 1888.

[14] University Medical Magazine, March, 1893.

[15] Nouvelle Iconographie de la Salpêtrière, 1891.

inger,[16] Weintraud,[17] Prince,[18] Lamacq,[19] Charcot,[29] Parmentier,[21] Brissaud,[22] Gilles de la Tourette and Zaguelmann,[23] and some of the cases of hæmatomyelia reported by Minor.[24] In many other cases where no diagrams are given, the descriptions indicate that the sensory disturbances were of the cerebral type.

In the two cases of my own which I have cited, I have indicated that the sensory disturbances were at times, or partially, of the spinal type. Max Laehr has recently made a very elaborate study[25] of the sensory disturbances

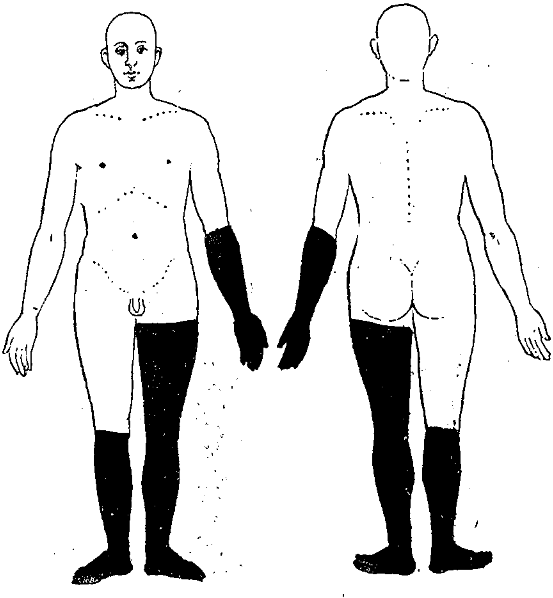

Fig. V.—W. H. Syringomyelia. Thermo-anesthesia.

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[16] Schlesinger: " Die Syringomyelie."

[17] Deutsche Zeitschrift für Nervenheilkunde, V., p. 383.

[18] " Dercum's Text-book on Nervous Diseases," p. 591.

[19] Revue de Médecine, April, 1895.

[20] Charcot: " Leçons du Mardi, II., p. 506.

[21] Nouvelle Iconographie de la Salpêtrière, 1890.

[22] Brissaud: " Leçons sur les maladies nerveuses," p. 191

[23] Nouvelle Iconographie de la Salpêtrière, 1889.

[24] Archiv für Psychiatrie, XXIV., p. 693.

[25] Archiv für Psychiatrie, XXVIII., p. 773.

in syringomyelia, based upon seven cases of his own and a thorough search through the literature of the subject; and he claims that the distribution of the sensory disturbances in syringomyelia is not exceptional and of the cerebral type, as has been claimed, but that it follows the usual rule and is of the spinal type. A considerable number of other cases beside these which Laehr reports, among them the cases of Runge,[26] Eskridge,[27] and Patrick[28] in this country are clearly of the spinal type, while others show a distribution, like that of the first diagram of my first case or in the case reported by Dercum and Spiller,[29] which may possibly be of the spinal type.

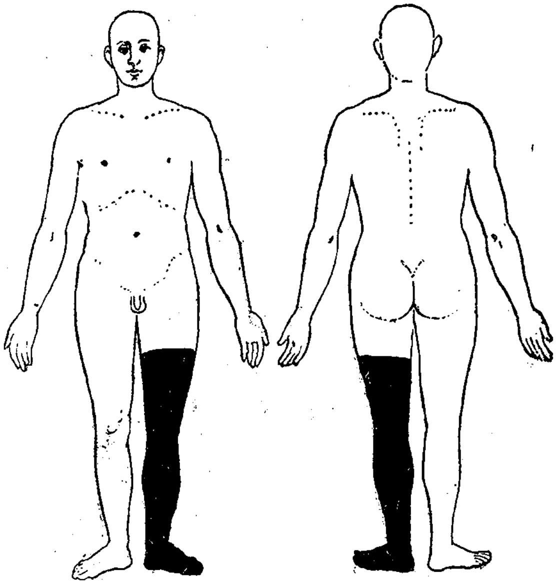

Fig. VI.—W. H. Syringomyelia. Analgesia.

It is needless to say that Laehr has not overlooked the many reported cases where the sensory disturbance was of the cerebral type. In the first place it may be urged that hysteria may show sensory dissociations similar to those of syringomyelia, and that hysteria and syringomyelia may co-exist. While this may be true, it is certainly a begging of the question, however, to assume that hysteria co-exists simply because there is an anesthesia of the cerebral type with no other sign of hysteria, and in a part at least of the cases to which I have referred, there was no other symptom of hysteria except this cerebral anesthesia.

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[26] Journal of Nervous and Mental Disease, Jan., 1894.

[27] International Clinics, Series III., Vol. 4.

[28] Trans. Amer. Neurol. Assoc., 1897.

[29] Amer. Journal of the Med. Sciences, Dec., 1896.

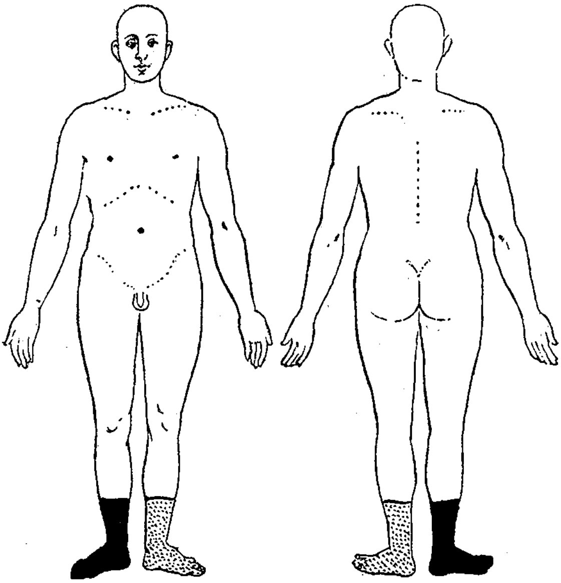

Fig. VII.—G. L. Tabes, Feb., 1897. Black, anesthesia; dots, analgesia.

Laehr's other explanation of the cases apparently of the cerebral type seems to me more valid. The sensibility to pain and temperature is less at the peripheral than at the proximal parts of the limb, as has been shown by Bernhardt[30] and Goldscheider.[31] The disturbances of sensibility in syringomyelia are often only slight, and the spinal areas, which toward the central end are narrow stripes running longitudinally, often at the periphery expand. In consequence of this, the narrow strip above, whether hypoesthetic or normally sensitive in contrast with the rest of the arm, for example, may be overlooked, and the hypoesthetic or normal area in the hand may alone be taken into account. Although this explanation is much more probable than to suppose that the sensory disturbances are hysterical, the cases where these disturbances are clearly of the cerebral type have been reported by so many different trustworthy observers that we must acknowledge, at least for the present, that in syringomyelia the sensory disturbances may be both of the spinal and cerebral type.

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[30] Bernhardt: "Die Erkrankungen der peripherischen Nerven," I., p. 99, et seq.

[31] Archiv für Psychiatrie, XVIII., p. 659.

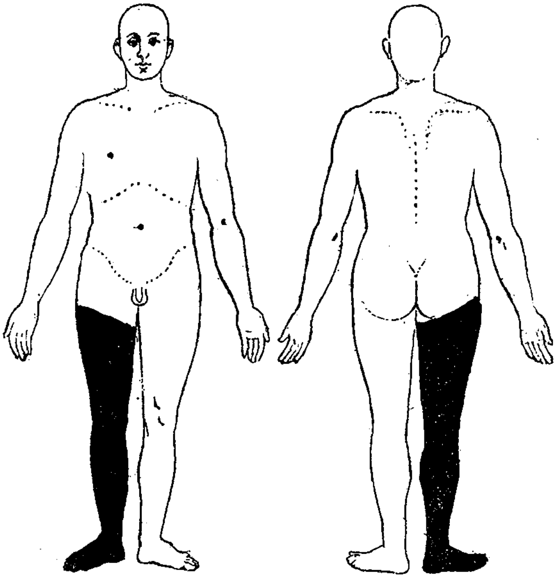

Fig. VIII.—G. L. Tabes, March, 1897. Anesthesia. Upper border not clearly defined.

Such a curious and apparently anomalous condition requires some explanation, and this has been attempted by Brissaud[32] who, be it said, rejects the ideas that the sensory disturbances may be hysterical, and admits frankly

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[32] Brissaud, op. cit., p. 219, et seq.

that they are due to the morbid process in the cord. Brissaud claims that the spinal segments themselves, at the cervical and lumbar enlargements, resemble the segments of the dorsal region. The lowest innervates the peripheral parts of the limb, the highest the proximal parts, and that the upper boundary of the anesthesia caused by a lesion of one of these segments is perpendicular to the axis of the limb—an anesthesia of the cerebral type. The spinal anesthesias are not due to lesions of the cord itself, but to lesions of the spinal roots. This, he thinks, affords a valuable guide in spinal surgery: if the anesthesia be of the root, or, as I have thus far called it, of the spinal type, there is a chance of success; if the anesthesia be of the medullary (cerebral) type, it shows that the cord itself is involved, and that an operation would be of no avail.

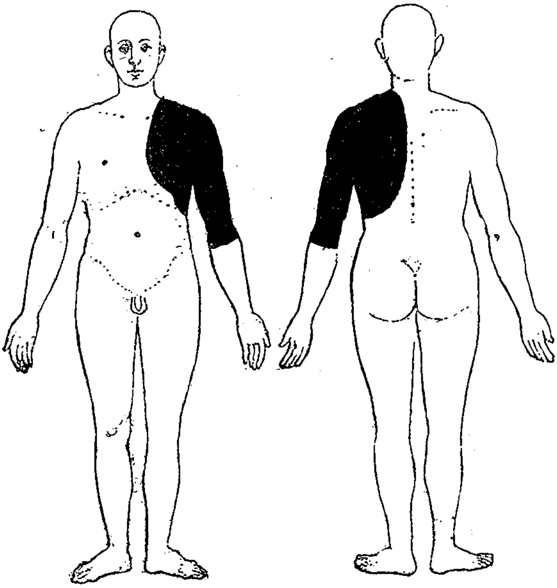

Fig. IX.—S. M. Tabes and muscular atrophy, April, 1896. Anesthesia and analgesia.

Chipault,[33] accepting Brissaud's hypothesis, reported two cases of hemorrhage into the gray matter of the cord, where this medullary distribution of the anesthesia was noted. In a subsequent study[34] of twenty-two cases of anesthesia in spinal caries, he found that seven presented anesthesia of the root type, six of the medullary type, two of the two types together, and seven of an indeterminate type. Chipault emphasizes the importance of this distinction pathologically, as indicating the seat of the lesion in the paraplegia of Pott's disease, in prognosis, since root lesions are less serious than those of the cord itself, and therapeutically, since if the cord itself be involved, the surgeon is not warranted in interfering.

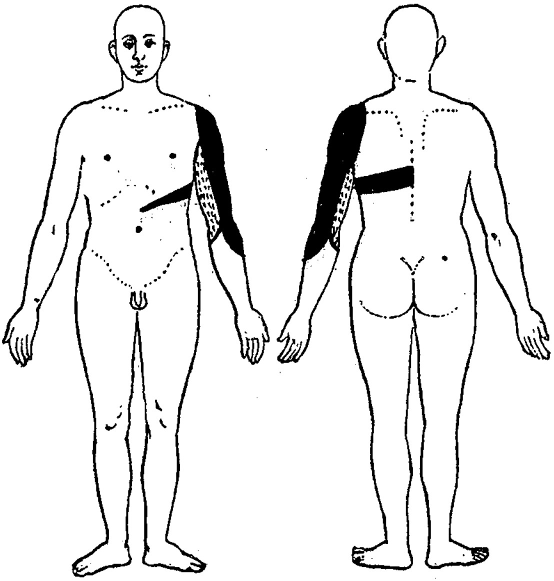

Fig. X.—S. M. Tabes and muscular atrophy, March, 1897. Black, analgesia; dots, hypoalgesia. No anesthesia.

The practical importance of this distinction between root and medullary anesthesias, if it can be maintained, is, of course, very great. The lesion in syringomyelia is most frequently central, which may explain why in so many cases the sensory disturbances are of the cerebral or medullary type. If the gliomatosis be situated more posteriorly in the neighborhood of the posterior roots, this may explain why in some cases, as Laehr has shown, the sensory disturbances are of the root or spinal type.

Assuming the validity of this distinction, it would naturally be expected that in tabes the sensory disturbances would be of the root type. This has been shown to be the case by Laehr,[35] Chipault,[36] and Patrick,[37] and in a number of cases I have been able to confirm their observations, especially in regard to the narrow band of anesthesia on one or both sides on the trunk. Nevertheless, in a number of cases of tabes which have come under my observation this distribution of the anesthesia has not been noted, or, when noted, has not been constant.[38] In the anesthesia

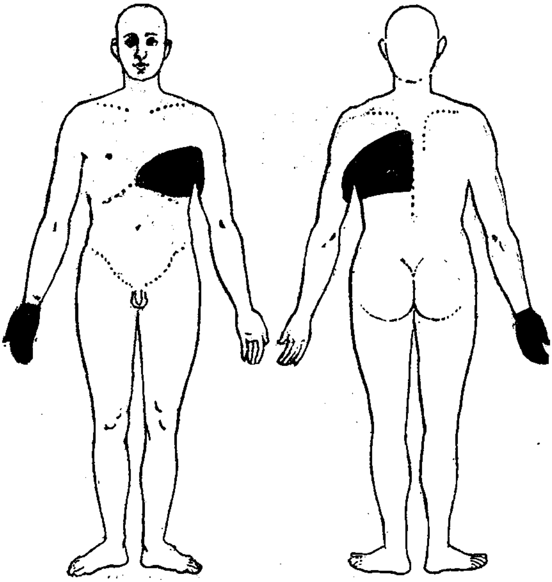

Fig. XI.—S. M. Tabes and muscular atrophy, April, 1897. Anesthesia.

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[33] Presse Médicale, Fed. 19th, 1896.

[34] Revue Neurologique, May 30th, 1896.

[35] Archiv für Psychiatrie, XXVII., p. 688.

[36] La Médecine Moderne, N. 44, 1896.

[37] New York Medical Journal, Feb. 6th, 1897.

[38] Through the kindness of Dr. Pearce Bailey I was made aware of the similar conditions observed in a large number of cases of tabes by Dr. Bonar, the result of whose observations have been published in the Medical Record of May 22d, 1897, since this paper was read.

of tabes I have not infrequently found that not only were the boundaries of the anesthesia vague, as they are apt to be in spinal diseases, but that they varied from one period to another. The following cases will show the conditions of the sensory disturbances.

G. L. (Figs. VII. and VIII.), a man of fifty-two, had syphilis twenty-five years before. Ten to fifteen years before I saw him he began to have lancinating pains. About two years before I saw him he noticed that the legs were clumsy when he tried to walk, and a little later the right hand and legs felt numb. Sexual power was lost. He swayed on standing with the eyes closed, the ulnar nerve was not sensitive on pressure, the knee jerks were lost, and the pupils reacted to accommodation but not to light.

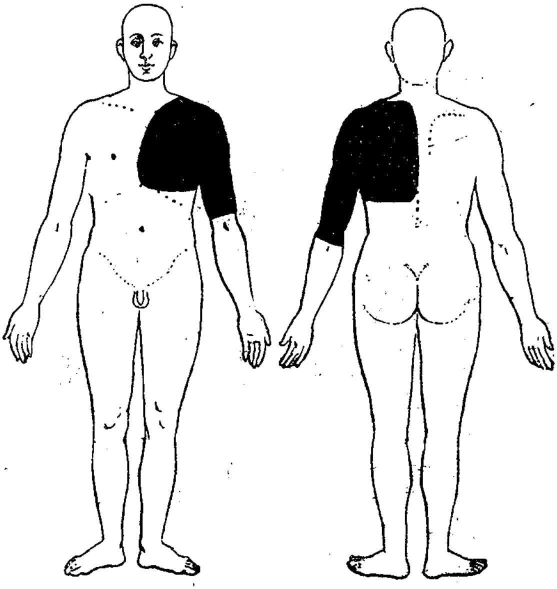

Fig. XII.—S. M. Tabes and muscular atrophy, April, 1897. Analgesia.

S. M. (Figs. IX.-XII.), a man of thirty-seven, had acquired syphilis some years previously. In 1895 he noticed weakness and wasting in the intrinsic muscles of the right hand. At about the same time he began to have lancinating pains in the arm and chest. Some months later the left upper arm began to atrophy. In the spring of 1896 there was marked atrophy of the left deltoid, scapular muscles, biceps and triceps, and some wasting of the forearm, and considerable atrophy of the right thenar and hypothenar muscles. The pupils were unequal and immobile. The knee jerks were absent. The sensibility to pain, touch and temperature was diminished as is shown in the diagram. The atrophied muscles showed some fibrillary twitching and electrical changes in the most affected muscles. In March, 1897, similar conditions of atrophy existed. The optic nerves were begining to atrophy. The

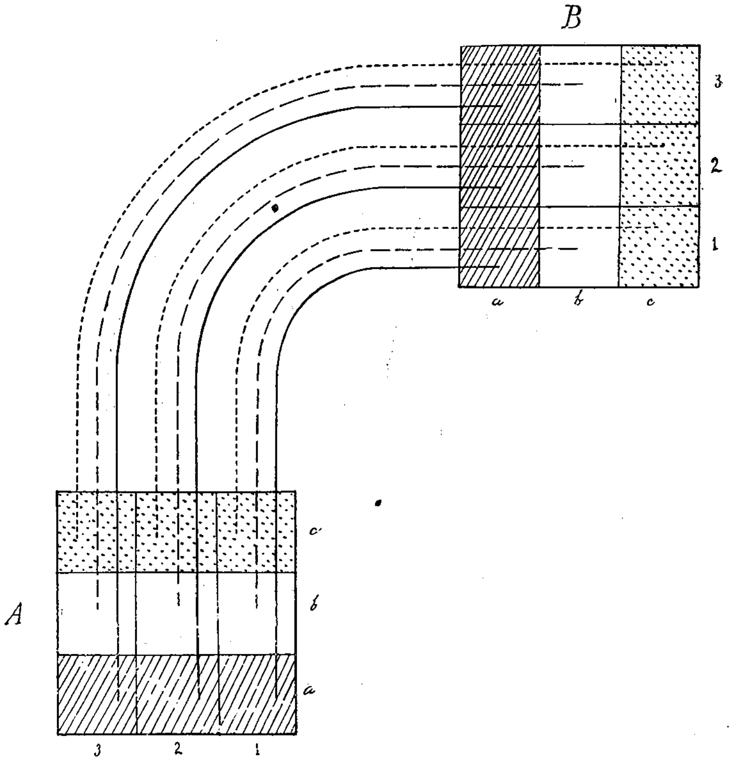

Fig. XIII.

ulnar nerve was analgesic. There was no anesthesia, but some analgesia, clearly of spinal distribution. In April, the sensory symptoms showed a change, anesthesia re-appearing, partly spinal, partly cerebral in type, with analgesia which was distinctly cerebral. The conditions in other respects were practically the same.

Such cases, which, as I have hinted, are by no means exceptional, show that in tabes we do not always find that the distribution of the sensory disturbances is of the spinal or root type, as would naturally be expected, if the hypothesis of Brissaud were accepted.

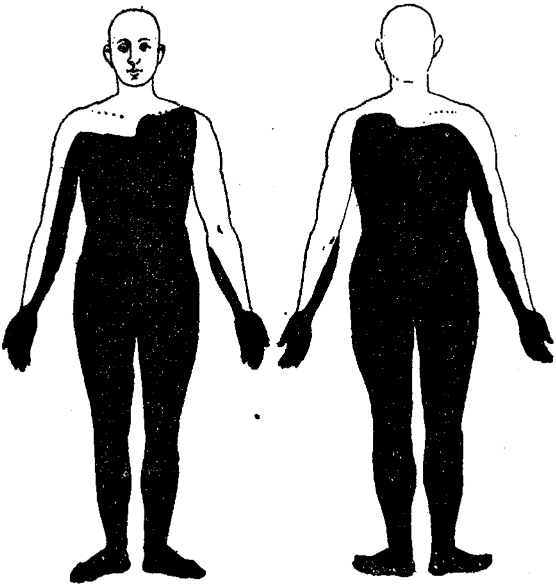

Fig. XIV.—E. R. Myelitis. Anesthesia.

Ballet[39] has advanced another hypothesis which is, perhaps, more satisfactory. Ballet has constructed a diagram (Fig. XIII.), which attempts to explain why the sensory disturbances in spinal disease are sometimes of one type and sometimes of another. In this diagram A represents

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[39] Bulletin Médicale, Sept. 23d and 30th, 1896.

the upper limb, and B the gray matter of the cord. For simplicity we may suppose that the cord sends out only three roots, 1, 2, 3, each of which supply a longitudinal area of the limb, 1, 2, 3. A lesion which destroys the root, or the segment from which it issues, will cause an anesthesia in the longitudinal strip, 1, 2, or 3. In syringomyelia the lesion involves a considerable longitudinal extent of the gray matter. If we suppose that in each root there are fibres which rise at a greater or less distance from the centre of the gray matter and go nearer to or farther from the extremity of the limb, then a lesion running longitudinally in the cord in the regions a, b, or c, will be followed by anesthesia in the regions a, b, or c in the limb.

The following case may, perhaps, be explained by this hypothesis: E. R. (Fig. XIV.), a sailor, forty-seven years of age, with a probable history of syphilis, had a severe attack of dysentery in the East Indies in the summer of 1896. In October he noticed a loss of power in the legs, which gradually grew worse. Later he had pain in the legs, numbness and stiffness of the hands, a girdle sensation, and dribbling of urine. When I saw him in February, 1897, he was almost wholly paraplegic; the arms and hands were very weak; he had cystitis, difficulty in micturition, and general pains. He had had bed sores. The knee jerks were lost, and the muscles of the legs failed to react to faradism. There was diminution of tactile sensibility, as shown in the diagram, which seems to be of a mixed type. The hypothesis of a myelitis involving the cord transversely up to about the first dorsal region, and then extending up in a small portion of the gray matter for a segment or two more, would, on this theory advanced by Ballet, account for such a distribution of the anesthesia.

Although this scheme proposed by Ballet may satisfactorily explain such a case as this, or the varying conditions of sensibility noted in syringomyelia, it is hardly applicable to tabes, if we accept the present ideas as to the pathology of tabes. If we assume that the primary lesion in tabes is a degeneration of the cell bodies of the peripheral neurons in the spinal ganglia, followed by a degeneration of the axis cylinder processes of these same neurons as they enter and pass upwards in the cord, then the sensory disturbance ought to be, as it so often is, of the root type. To explain other types of anesthesia we would have to assume changes in the gray matter of the cord beyond the simple degeneration of the sensory neurons. That such changes exist, at least in the more advanced cases, is well known, but their relation to the sensory disturbances is still problematical.

The relation of sensory disturbances to lesions of the spinal cord is, therefore, still undetermined. In many affections, notably syringomyelia, caries and tabes, we find such disturbances sometimes of the spinal and sometimes of the cerebral type. It is possible that sensory disturbances of the spinal type point more to lesions in the neighborhood of the posterior roots, and those of the cerebral type to lesions in the neighborhood of the gray matter, but that is still problematical. The scheme which Ballet presents affords a somewhat more satisfactory explanation than Chipault's original division into root and medullary types, but it is by no means conclusive.

(To be continued in the October number.)